ELECTRICAL REVIEW

[ILLUSTRATED]

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A New Electro-Magnet.

The ordinary electro-magnet has the inconvenience of ceasing to exert an influence upon the armature at a short distance (generally a quarter of an inch) from its poles.

Mr. Stanley Currie has recently devised a new form, whose field of attraction is much greater, since it acts at a distance of 3½ inches. This new magnet is a combination of the horse-shoe electro-magnet and the solenoid. As shown in the engraving, it consists of a vertical bobbin with a tubular soft iron core. The wire which is wound upon the bobbin is surrounded by an envelope of soft iron of the same weight as the core, with a soft iron tube at the end of the bobbin that connects the core with the external envelope. The top of the bobbin is covered with a brass disk. The copper wire used is No. 18, Birmingham gauge, and 0.048 inch in diameter.

The armature consists of three parts, viz., of an iron rod inclosed in a brass tube, which is prolonged beneath it so as to guide it in its upward and downward motion in the tubular core, and of a soft iron cover fixed to the top of the central rod, and connected with the cylinder which forms the external envelope of the bobbin. This cover is preferably made with two or more layers of flat plate, so as to facilitate demagnetization, but it must be thick enough not to be saturated by an ordinary current. The cylinder has a rim that enters the field of attraction of the external envelope as soon as the lower extremity of the central rod enters the tubular core. When the effect of such attraction has made itself felt, the upper flat plate is in the field of attraction not only of the envelope, but also of the internal core, and the field of attraction of the magnet is, so to speak, prolonged.

As long as the central rod is exterior to the core of the bobbin, the attraction to which it is submitted is always in ratio inverse the square of its distance from the bobbin; but, as soon as the extremity of the iron rod enters the aperture in the core, the part that rests therein loses its power of attraction. The same diminution of attractive power occurs in the rim of the armature's disk as soon as its lower edge passes under the upper edge of the bobbin. The power of attraction likewise varies directly as the mass of the body attracted, and these two effects have been combined in order to regulate the attraction so that it shall be approximately uniform across the field of 3½ inches. This is effected by cutting the lower end of the rod of the armature, as well as the rim. If necessary, the thickness of the upper disk and the width and thickness of the rim may be varied. The latter may also have its edge scalloped (Fig. 2), so as to prevent a sudden increase of attraction in measure as the disk approaches the bobbin. The result of this arrangement is to increase the stress upon the disk in measure as the latter approaches the pole of the magnet, when the force of the stress upon the armature rod and rim is diminishing. In this way, and by the combination of a counterpoise, there may be obtained a sufficiently uniform stress with considerable travel, and a violent contact be avoided when the disk reaches the pole of the magnet.

The stress or range of the attraction may be doubled with a pair of these magnets placed at a certain distance apart, and having the same armature rod. The lower armature is fixed to the rod, and the other simply bears against it through a projection. The upper armature is first attracted, and, when it has placed itself upon its own bobbin, the lower one has come into the field of attraction of *its* bobbin, and may be attracted to it, so that, by this process, the travel is doubled.—*La Lumiere Electrique.*

FIG. 2

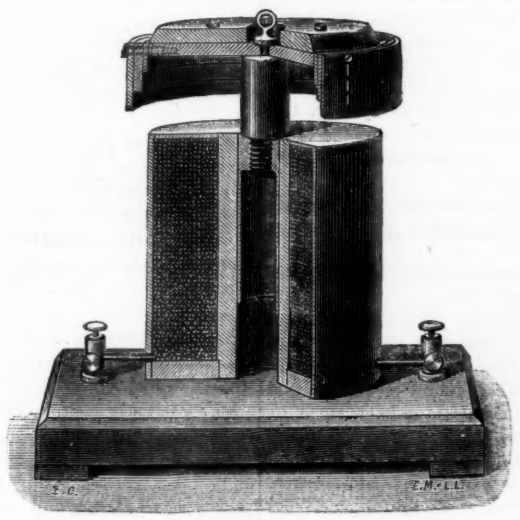


FIG. 1.—CURRIE'S ELECTRO-MAGNET.

The "Sun" Lamp.

Our esteemed contemporary, the London *Electrical Review*, gives the following description of the above lamp:

The hand lamps in their present form have the same system of lighting as the automatic ones. Only the raising of the weight of 1,500 grammes is performed by hand. The weight is suspended on a chain, and may descend to be easily reached at whatever height the lamp may be. The recoil can also be regulated in this case, and there is no longer the risk of too sudden lighting. This lamp costs less than the automatic one.

Lastly, the workshop type comprises no more than the case and two pushing springs. The lamp is lowered to be lighted, the small carbon being worked by hand. This lamp is of the simplest type possible, and is also the least expensive. We see thus that each model is very complete and answers its purpose well, the price being in proportion to the commodity.

Various attempts have been made to substitute for the marble a body offering more resistance to damp than lime does. This has always been tried with magnesia. The light is much less brilliant, which fact has discouraged the inventors from proceeding with their endeavors.

When magnesia is obtained at a low price, there will be an economical advantage. The lamp will be made with rather long carbons so as to last several weeks, and these advantages will compensate for the comparative dullness of the light. In another way, perhaps, the employment of magnesia may be increased.

M. Clerc has shown that if we pierce a hole in the marble to arrive at the center of the arc, and blow air through the aperture, the arc is projected beyond the marble, and the light is greatly increased. If, instead of air, gas is blown through, and especially hydrogen, the light is more than trebled. If the block is sufficiently hollowed out, this lamp burns without any inconvenience. The illuminated area is much more considerable, and the color magnificent. The increase in force necessary is only 25 per cent. As in this case the block no longer serves to produce any light but only to stop the carbons, magnesia would be perfect. This arrangement involves a little extra expense in the installation; but the advantages are so great that this kind of lamp cannot fail to come into favor.

For a long time endeavors have been made to find out what length of arc is best as regards efficiency. M. Clerc showed, about April, 1882, that the arc only increases as a resistance 2 per cent. per millimeter of marble placed between the carbons, whereas from 10 millimeters to 30 millimeters the light increases about from 1 to 3. The question is, therefore, settled; it is best to have the arc from 25 to 30 millimeters, which is the dimension adopted in London by the Sun Lamp Company. As regards intensity, the highest gives the best rendering. M. Clerc, in fact, showed that the resistance of the lamp varied in the proportion $\frac{K}{I\sqrt{I}}$ which shows that the work varies in the ratio of $\sqrt{I}$, which conclusion has since been confirmed by the Wattmeter.

As the light varies in the ratio of I, we see that the rendering increases quickly with I. But with marble we cannot exceed certain intensities. Experiment shows that about 12 amperes is a practical maximum. Higher intensities can be employed, 16, 20 and even 25 amperes, but the marble does not last nearly so long. It is best to use 12 amperes with 30 millimeters of arc. This gives 2,200 candles, and, as we shall see later on, the mechanical and electrical work does not exceed 2 horse-power per lamp. We get, therefore, 1,100 candles per horse-power. With this rendering and the cylindrical boring of the marble, the useful effect of the Sun lamp is considerable. There is, however, one respect in which force can be economized, *i. e.*, on the carbon.

As it has been established, the work in every arc consists of the work due to the formation of the arc and that due to its length. In the Sun lamp the work due to the formation of the arc is very important, owing to the large dimensions of the carbons, which, although protected against the cold, heat very slowly, and render the formation of the arc difficult. In ordinary lamps the section of the carbon is 4 millimeters per ampere. In the Jablochkoff candle it is 1½ m. In the Sun lamp it is 30 millimeters per ampere. This is why the linear consumption is so slight, although economy is also observed in the carbon burnt by combustion in other lamps. With the ordinary arrangement, the diameter of the carbons cannot be reduced, as they would then burn the marble too much owing to their greater heat.

We must, therefore, turn our attention to the composition of the carbon. The more compact the carbon is the less easily is it heated, for the heat of the part in which the arc is formed easily spreads into the carbon. We require, therefore, a very soft carbon that is a bad conductor of heat. Messrs. Varley have made for the Sun lamp some carbons of carburetted silk which answered this purpose. The force required by two similar lamps placed in the same circuit, the one having ordinary carbons and the other the Varley carbons, showed that the latter gave an economy of force of 20 per cent.; the light was weaker. The rendering seemed little increased.

In order to employ small carbons, the intensity must be diminished, so that the marble is less easily penetrated. With 4 amperes, we can employ carbons of 6 millimeters consuming at the rate of 10 millimeters per hour; with an arc of 10 millimeters, we get a light of 200 candles, requiring 0.5 horse-power as mechanical and electrical work.

These lamps are suitable for small spaces, although giving about half the rendering of the larger ones, and for industrial purposes may be extensively used.

The Sun lamp, with a constant distance between the carbons, is polyfocal, and as there is no mechanism, even for regulating the advance of the carbons, no perturbation is possible, and a large number of lamps can be placed on the same circuit without inconvenience, especially when lighted with the regulated recoil.

However high may be the tension employed in the circuit, there is no danger in handling the lamps even while they are at work. In fact, if it is necessary to attend to a lamp that has been overlooked, and that while they are in action, each lamp is provided with a double cut-off, which introduces a short circuit in the place of the lamp, and at the same time completely insulates from the circuit the two wires conducting the current to the lamp, which can then be touched without the slightest danger. The double cut-off constructed by M. Clerc acts by means of a heavy weight placed above

the axis of oscillation. This weight falls either to the right or left, making short circuit, or allowing the lamp to burn, but it cannot remain in this intermediate position. It is, therefore, placed on the top of the lamp, and worked from a distance with perfect safety. We thus realize in many cases an economy of wire, and the installation is more easily managed and cleaner.

The Sun lamps can, therefore, be placed in large numbers on a circuit; but can it burn in parallel?

In ordinary form the lamp is one with the distance between the carbons constant, and not regulated. As in all lamps of this nature, its resistance diminishes rapidly when I increases. Thus, a lamp placed on an Edison machine of 100 volts increases in intensity from 15 to 50 amperes, and then the marble melts. In fact, at 15 amperes, if the resistance tends to diminish, the intensity increases, then the resistance diminishes again, and so on.

In order to burn, the lamp requires a regulated current as produced by some dynamos, or a current regulator; this might be a wire, which, placed on a circuit of the lamp, becomes heated when the intensity increases, and, increasing in its resistance, corrects the diminution in resistance of the lamp due to the increase of intensity, and *vice versa*, or it might be an electrical regulator. By placing on the same derivation with each lamp a thin iron wire, Prof. Garnett, of Nottingham, burnt some Sun lamps in parallel with some incandescent lamps from a Ferranti machine.

The regulating apparatus absorbs a considerable amount of force — from 20 to 25 per cent. It is possible, however, to work a Sun lamp without sustaining this loss. To do this it is sufficient to make one of the carbons smaller and movable, and to regulate it by a coil placed after the lamp on the same derivation.

As the resistance of the lamp decreases, the coil draws back the carbon, and *vice versa*. This type of lamp is monofocal, and to be used with a direct current, as the coil in that case can be kept in the circuit without taking a noticeable amount of power, as it was the case with alternating current. The movable carbon will be the negative one, which, in the Sun lamp, does not cousume at all, as we see the movable carbon is impinged by a weight which can be regulated so as to obtain the required intensity.

When placed in a circuit of constant potential, this arrangement will keep the carbon in the proper position to maintain a constant intensity.

This model will be used with all direct dynamos giving a current of 90 volts or more, whether the dynamo is made for one lamp only or for a given number to be worked in parallel circuit.

In the latter case, if some lamps have to be lighted independently of the others, the switch of each of them must be fitted with a small resistance coil, to prevent the other lamps being affected when the carbons are brought into contact to light the lamp.

This type of lamp will be fit to be placed in the circuit of the dynamos working incandescent lamps. Each of such lamps burning with 10 amperes and 100 volts will require the same power as 12 incandescent lamps, and give seven to eight times more light.

The light of the Sun lamp being steadier than that of incandescent lamps, as it is less affected by the variations of speed of the motor, and the tone of the light being less reddish, it may be used in preference in many cases, especially when incandescent lamps are intended to be used in lusters.

If series direct-current dynamos be used, the lamps must be polyfocal, and the coil moving the carbon is wound with thin wire and shunted on the lamp. In this case the coil impinges the carbon when the resistance increases, and the regulating weight is used to draw the carbon back. If in this case the lamps are intended to be lighted separately, a second coil is used to push the movable carbon rapidly in contact with the other. This last coil, wound with thick wire, is at the same time the resistance of the safety switch, which we have described before.

As soon as the contact is formed, this second coil is cut out, the movable carbon is drawn back by the weight, and the shunted coil will alone regulate the position of that carbon. Such an arrangement may be used with all ordinary arc lamps.

The Sun lamp, either with a constant distance between the carbons, or with one of them movable, can be used with nearly all dynamos in use, provided the current be from 90 to 100 volts per lamp, the intensity being from 8 to 14 amperes.

Let us now consider specially the type of lamp most in use—*i. e.*, with constant distance between the carbons—and discuss the dynamos used to work it.

As we have seen that the resistance of these lamps diminishes in the inverse ratio of $I\sqrt{I}$, like all lamps at fixed distance between the carbons, and that it cannot be regulated, it is the machine that must serve as regulator and maintain the intensity. With alternating current machines, this regulating is effected more or less by the machine, according to its nature, as in all alternating current machines the electromotive force increases with the external resistance, thus regulating the variations in resistance of the lamp. In continuous current machines having the inductor and the induced part on the same circuit, the machine no longer regulates, but, on the contrary, is very much affected by the variations in the lamp. With the least slipping the lamp cannot burn, and a large increase of speed is necessary or a wire serving as a regulator is introduced into the circuit. Otherwise, if the lamp increases in resistance, the intensity is diminished, the inductor becomes weakened, and so on until extinction ensues.

In order to burn with continuous currents, shunted machines are necessary. In this case, if the resistance of the circuit increases, the inductor becomes stronger, and the lamp or lamps are regulated.

With machines of this kind at 10 amperes the lamp works very well.

With the Brush machine the lamp works pretty well, although the machine is not sufficiently shunted.

Thus we can employ either the continuous current or the alternating current at will. For small installations continuous current machines are undoubtedly the best. For high tensions continuous current machines are more difficult to attend to on account of the collector, and because of the danger of the extra current in case the circuit is broken. Besides, continuous current machines cannot be adapted to division like alternating current ones. Lastly, as we shall see later on, the force taken will be important as a guide to us.

The alternating current machines employed up to now have been those of Gramme, Lachaussée and Maquaire. But none of these suit the Sun lamp so well as that of the inventors of the lamp—Clerc and Bureau Having observed that machines having their wire perpendicular in the axis of rotation (Lachaussée and Maquaire) were much more noisy than those having their wire parallel to this axis, which is easily explained by the more sudden magnetization and demagnetization, M. Clerc endeavored to construct a machine with its wire parallel to the axis of rotation.

Having examined the advantages of the Pacinotti rings, he decided on a machine of this type. In order to allow of the use of powerful inductors, he was obliged to make the soft iron core of insulated iron wire.

He wound on a wooden core in two pieces some insulated iron wire, fixing each layer with strong glue. Then cutting the iron wire with the saw, he obtained two solid armatures in the form of a horse-shoe. On these armatures he wound the wire, and thus formed the coil.

In conjunction with M. Bureau, he then constructed the machine described in the same number of *Engineering*, which fed 25 lamps, of 25 millimeters, at 10 amperes, at the Health Exhibition, and which was patented in June, 1883.

In this machine all the coils are homologous, and can be joined either in quantity or in tension, all together or separately. Homologous coils are indispensable for incandescent, secondary generators, and for easy combination of arc lamp circuits. In this machine the coils are all insulated from one another completely, and also from the frame of the machine. The inductor is revolving, which allows constant attention to the armature. This is a very important consideration.

Lastly, each bobbin is easily taken off and replaced, even when at work, for it is only necessary to withdraw four screws, which is also a very important matter in extensive lighting.

Each coil has its wire attached in two fixed terminals, mounted on wood, at the side of the machine. The wires of all these terminals are connected with a commutator fixed to the side of the machine, on which the groupings are easily performed.

Test of Edison-Hopkinson Dynamo in London for 250 Amperes and 55 Volts.

The dynamo is of the latest Edison-Hopkinson type with a short armature. The exterior dimensions are: Length, 56 in.; breadth, 36 in.; and height, 60 in.; and the net weight of the machine complete is 32 cwt.

The commutator is of copper with mica insulation, and has 40 bars, and is provided with double brushes independently adjustable. The magnets are shunt wound.

Magnet resistance is....	7.54 ohms.
Armature "	0.009 "

The dynamo is designed for a continuous load of 250 amperes and 55 volts, and to run at a speed of 900 revolutions per minute.

The efficiency of the machine is deduced from the following figures:

	Watts.	H. P.
Total electrical power developed.....	= 16,246	= 21.78
Loss in magnets.....	= 401	= 0.54
Loss in armature.....	= 720	= 0 96
Power available in outer circuit when run as in test.....	= 15,125	= 20.28

Hence—

Electrical efficiency....	= 93.1 per cent.
Loss in magnets.....	= 2.4 "
Loss in armature.....	= 4.5 "

The following are particulars of the test to which this machine has been subjected:

The dynamo was arranged for driving by an ordinary strap from a double cylinder engine made by Mather and Platt, and carried on slide rails to permit of the belt being tightened if required. One of Sir William Thomson's graded potential galvanometers was permanently coupled to the machine to give a continuous indication of the electromotive force between the terminals, and arrangements were made for measuring the current by means of a current galvanometer, also of Sir William Thomson's graded type.

The temperature of the bearings was measured throughout the test by means of thermometers placed in mercury cups attached to the bearings, and a continuous record was kept of the temperature of the room.

The speed was indicated by a tachometer attached to the engine, and the revolutions of the dynamo counted from time to time with a counter.

The load was maintained constant throughout the test, as nearly as possible at 275 amperes and 55 volts, measured at the terminals. This is 10 per cent. above the normal load for which the machine is intended.

The machine was started on December 30th and ran for five hours, when the temperatures were taken as follows:

	°C.		°C
Room.....	17	Magnets.....	33
Pulley bearing	35	Armature....	76
Commutator bearing.	36	Commutator..	70

At the end of twelve hours' run the temperatures were again taken.

	°C.		°C.
Room.....	20	Magnets.....	33
Pulley bearing.....	36	Armature....	84
Commutator bearing.	34	Commutator..	75

Again, at the end of twenty-four hours, the temperatures were:

	°C.		°C.
Room.....	15	Magnets.....	33
Pulley bearing.....	30	Armature....	76
Commutator bearing.	29	Commutator.	74

Showing that at the end of twelve hours the maximum temperatures had been reached in all parts of the machine. Subsequently, throughout the entire run of three weeks' duration the temperatures did not vary more than was accounted for by variations in the temperature of the room.

The speed maintained throughout the run varied from 910 revolutions to 925 revolutions, with the full load, and the armature and magnets warm.

The machine was run continuously, stopping ten minutes daily to read the temperatures of the armature and commutator, and for Sundays, until January 6th, when it was stopped in order to take out the armature and have it examined to determine if there were any sign of charring or deterioration in the insulation of the wire, and in order carefully to examine the commutator. The examination was conducted by Mr. Blackburn, on behalf of the Edison and Swan United Company, and no change whatever was observable either in the insulation of the wires of the armature or in the commutator.

It was then decided to run the machine absolutely continuously for a fortnight without any break whatever with the full load of 275 amperes. This test concluded on January 20th.

Throughout the whole of this continuous run of fourteen days there was never the slightest sparking at the commutator, the bearings and magnets remained at a uniform temperature throughout, and the temperature of the commutator at the end of the run was was 79° C.—practically the same temperature as at the end of twelve hours. One set of brushes was used without change of adjustment for twelve days, and at the end were found to be worn down uniformly $\frac{1}{16}$ in.

The commutator was perfectly smooth, and showed no signs of wear or grooving, and the armature had stood the run without the slightest swelling or any sign whatever of change in the insulation.

These tests were undertaken by Messrs. Mather and Platt at the request of the Edison and Swan Company, in order to show the durability of the Edison-Hopkinson dynamo under a long and continuous strain, with a load 10 per cent. in excess of that for which the machine is sold. The conditions of the test were formulated by Mr. Albright and Mr. Blackburn, on behalf of the Edison and Swan Company, and it was superintended by them and their representative, Mr. Creagh, during the entire run.

It was claimed that a dynamo of this type may be run continuously without any change in its working parts, or deterioration in the insulation of the copper conductors, or change in their resistance, and that the wear is exclusively confined to the commutator and copper brushes, and that with regard to the former three weeks' run is not sufficient to produce any visible wear, and that the brushes last much longer than usually supposed, one set of them being capable of lasting quite a year on a machine running, on an average, three hours every day.

—— Some of the shops in the Passage des Panoramas, Paris, are now lighted by 50 Woodhouse and Rawson 10-candle incandescent lamps, giving out 0 7 amp. at 40 volts, maintained by 22 Faure-Sellon Volckmar accumulators, charged by a Gramme shunt-excited dynamo, driven by a 4-horse Otto gas engine. The installation was made by Liepmann Freres; and the following are given by *L'Electricien* as the advantages attending the use of accumulators: 1. Whatever may be the irregularities of the motor, the current sent through the lamps is perfectly constant; 2, the motor always works up to its full power, and therefore economically, whatever be the number of lamps in circuit; 3, the engine need not work all the time the light is required, but only so long as may be required to recharge the accummulators. At present the subscribers are only charged at gas rates for an equal light; but it is hoped that the lighting will be extended throughout the arcade, when the charge will be made by meter.

Wimshurst's Electric Machine.

We have, from time to time, says London *Engineering*, described the very interesting electrostatic induction machines of Mr. James Wimshurt, one of the consulting engineers to the Marine Department of the Board of Trade, and who, combining as he does a remarkable intuitive knowledge of electrical matters with great skill as a mechanician, has designed and constructed a number of new forms of induction machines of a high order of excellence and originality, and which he has moreover freely given to the world. These several machines form so many advanced links of a most interesting chain of development in the history of electrostatic science, besides placing in the hands of the physicist and science student most valuable additions to high-class apparatus at their command, and which can be made and supplied with a reasonable profit at an exceedingly moderate cost.

"We illustrate on the present page a machine which has just been completed by Mr. Wimshurst in his own private workshop, and which is, undoubtedly, the most powerful and efficient electrostatic machine in existence. This apparatus has been constructed for and presented to the Science and Art Department at South Kensington by Mr. Wimshurst, the cost of the raw material being defrayed by the Department.

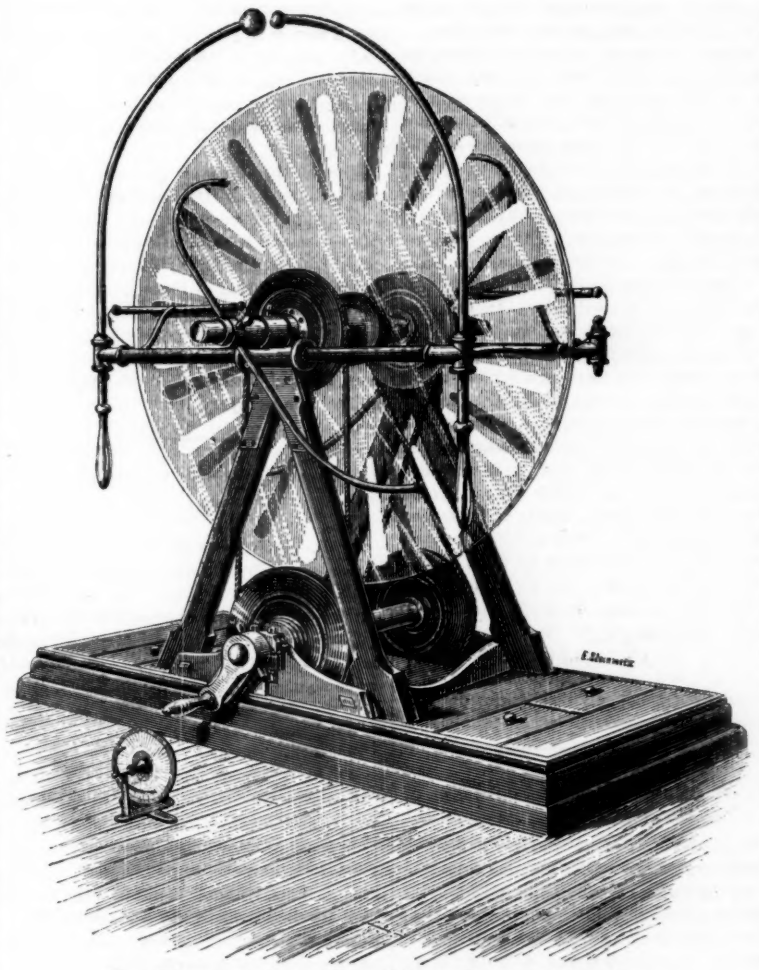
On reference to the illustration it will be seen that the form of this machine is nearly identical with the smaller type which we illustrated and described two years ago; its points of difference lying in its size and in the construction of the supporting parts, which the greater weights have necessitated. Thus, while the diameter of the circular plates of the smaller machine was 14½ in., that of those of the great machine is 84 in.; the former being cut out of ordinary window glass, while the latter are discs of plate glass ⅜ in. in thickness, and weighing 280 lbs. each. Each of these discs is pierced at its center with a hole 6½ in. in diameter, and is firmly attached to a gun metal boss 15 in. in length, carrying the disc at one end and a pulley at the other, and which is bored so as to run freely on an iron tube 3 in. in diameter, this tube being supported at each end by strong oak trusses, rising from a firm base, also of oak, and which is fitted with lockers at each end, for holding spare parts and accessory apparatus. The heads of the two trusses, or **A** frames, consist of massive castings of gun-metal, which are so shaped as to hold the hollow iron tube and the ebonite rod to which the collecting combs and discharging terminals are attached. The iron tube projects at each end beyond the trusses, and to the projecting ends are attached the brass "neutralizing" rods, which terminate in light wire brushes, shown in the illustration.

To the discs, which are well varnished with an alcoholic solution of shellac, are attached, at equal angular distances apart, radial sectors of tinfoil, sixteen on each disc. These sectors are 19 in. long, and have a mean width of 1.65 in., thus having an area of 31.35 square inches. There is thus on each plate a metallically coated area of 500 square inches, or a thousand square inches on the two discs together.

As we have in the article in our thirty-fifth volume, to which we have before referred, described the principle and action of Mr. Wimshurst's electrical machine, we need not repeat it here, but we may remind our readers that the apparatus may in principle be regarded as a sort of double-acting "Nicholson's revolving doubler," the sectors on the one disc acting as inductors on the other, and *vice versa*, and that the extraordinarily high efficiency of the machine is probably due to the fact that both plates contribute charges of electricity to the collecting combs, and that the sectors on the one disc act as inductors and as carriers respectively to those on the other when they approach the best positions for those respective actions to take place.

The collecting combs are attached to the discharging terminals, as shown in the engraving, by interchangeable brass rods, some being straight, while others are bent, so that their positions with respect to the horizontal diameters of the discs may be varied within a range of about 16 in., that is to say, between about 8 in. above and 8 in. below the horizontal diameter. The discharging rods or terminals are constructed of brass tubes 1¼ in. in diameter, and are fitted with terminal balls of different diameters, which are also interchangeable. The distance of these balls apart—and therefore the striking distance of the spark discharge—can be varied by the glass handles with which the discharging rods are fitted at their lower ends, and as these handles have their attachment in a hinge-joint, they can be used as levers wherewith to turn the terminal rods around a vertical axis, and thus to vary the distance between their upper ends.

The two discs are rotated in opposite directions by the lower driving gear shown in the figure; this consists of a horizontal spindle fitted with a winch handle at each end, and carrying a pair of oak pulleys which are connected respectively to the two pulleys attached to the discs by endless cords, one of which being crossed, causes one disc to be rotated in the opposite direction to the other; and as the height of the bearings of the lower spindle is adjustable, the driving cords can always be maintained perfectly tight.



THE WIMSHURST SEVEN-FOOT DUPLEX ELECTRIC MACHINE.

The principal characteristics of this form of electrostatic machine, and to which its exceptionally high value as a laboratory instrument is due, are (1) that it is readily self-exciting in almost every condition of the atmosphere; (2) that the polarity of the apparatus never changes, as it is so liable to do in other forms of induction machines; (3) that the charge is very large compared with the area of the glass employed in the discs, and (4) the small cost at which the machine may be constructed.

Although the great machine which we illustrate in this notice was working in a workshop in which there was a steam engine and boiler at work, and consequently with a considerable quantity of water in the atmosphere, and although it was closely surrounded with lathes and shafting and other metallic conducting bodies, not only did it pick up its charge even before a complete revolution was made, but kept up a constant stream of discharge sparks between its terminals of over 14 in. in length. The results have already proved far more satisfactory than was anticipated before it was tried, but when it is set to work at South Kensington (where it will be installed by the time these words are before our readers), and where it will be under far better conditions for developing its full powers, still higher results may be expected. We may, indeed, congratulate Professor Guthrie and the science schools generally, on this new acquisition to the physical laboratory, which must prove a most valuable instrument for experimental research.

Mr. Wimshurst has in his laboratory what is probably the largest collection of the most powerful electrostatic induction machines in existence, having worked for several years in perfecting this class of apparatus. We have in the illustration introduced (partly to serve as a comparison of size and partly to illustrate a very interesting and typical form of the apparatus) a sketch of what is perhaps the simplest and the cheapest electric influence machine ever constructed. This little apparatus consists simply of two discs of varnished glass 12 in. in diameter, fitted with tinfoil sectors, and mounted on a spindle, which can be held in the hands, and the discs can be rotated in opposite directions by spinning them with the finger and thumb. When this is done—although there are no collecting combs or discharge conductors—the most brilliant effects can be produced, the whole apparatus literally bristling with electric discharges immediately the rotation commences, and one of the most remarkable and not the least valuable features of this beautiful little instrument lies in the fact that it can be constructed in a good salable and workmanlike manner, and sold at a very small charge."

The Pennsylvania Railroad Company is making experiments at its shops in Altoona, Pa., with electric lights for use in passenger cars. The experiment has progressed so favorably that it is believed that within a few months the electric lights will be introduced into all passenger cars on its various lines.

The Decadence of Science About Boston.

A Bostonian, proud of the scientific fame of his native place, and yet only too familiar with empty benches at the ordinary scientific assemblages, and to whom the election of new members, "postponed for want of a quorum," is a standard event, when he visits Baltimore and Washington, begins to ask whether the scepter has not departed from Israel. He is thereafter a little shy about inviting a brother physicist from Baltimore to attend a meeting of the academy, or taking a naturalist from Washington into a session of the natural history society. To a friend about to visit the national capital, he unburdens himself with sad forebodings of the decadence of science at home; but "tell it not in Gath," he whispers as he parts. Nevertheless, it is an open secret.

The actual state of things is simply this,—that the meetings of scientific societies at Washington and at Baltimore are much more numerous and more specialized than at Boston and Cambridge, and present at nearly every session a more varied and interesting assortment of papers, which receive wider and freer discussion at the hands of much larger audiences. So far as interest and attendance go, the meeting in the southern city is what it formerly was in the northern; and it is a pleasant and yet sad reminiscence of earlier and better days for a scientific man from Massachusetts to visit his confreres at the south. He sees again the freshness and eagerness he was wont to see at home. The audience does not sit around the rear door, hat in hand.

It is not easy to see the exact reason for all this changed aspect of affairs in the north. Assuredly, never was more expected of science than at the present day. All men attend her words. Is it that each specialist has become so engrossed in the little corner of the universe he cultivates that he can scarcely see beyond that corner, and must needs keep to it even when he shows its products? Yet why should one's mental horizon be narrower at Boston than at Washington, at Cambridge than at Baltimore? The only way we can account for this is in the undoubtedly freer social life at the south, by which men are brought into more frequent collision, with consequent interchange of ideas; and this would lead one to conjecture, that, unless manners change, Boston and Cambridge cannot regain pre-eminence.

It is all very well to say with a complacent air that science does not depend on the public, and that her great discoveries are made far from the noisy world. It is only in exceedingly rare instances that they have been made by men whose scientific ardor was not born of contact with living teachers. And men who seek wisdom for themselves alone defraud the public; especially in these latter days, when it is this very public that is to furnish their successors in the investigation of nature. The public covets no man's scientific gold or apparel, but has a not altogether unwholesome yearning for a sight of it; and it is a travesty of the scientific spirit to keep it from view. Science may be a mild hermit; she can never be a miser.

But to return to Boston. The decadence noticed within the last ten years cannot be attributed to any change of general manners in the modern "Athenian," but must be sought in other local causes, and may be largely apparent. The increasing proportion of scientific men residing outside of Boston itself has much to do, during the colder and stormier season, with the small attendance at meetings which it takes an hour's travel to reach; and yet it is rare to find at any scientific gathering in Boston, even if it be an attractive feast, any less proportion than one-half from Cambridge. The university, too, makes larger and larger demands upon its servants; and the extraneous attractions of Cambridge itself, not to mention those of Boston, absorb more and more the time and strength of those who were wont in former years to add to the interest of the scientific meetings in Boston. Their example is followed by their juniors, and Boston itself fails to make good its own loss.—*Science.*

ELECTRICAL REVIEW
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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Mr. J. Viennot, 150 South Fourth Street, Philadelphia, is our accredited representative for Pennsylvania

Mr. Charles W. Price, Grand Pacific Hotel, Chicago, Ill., is our representative for the West.

Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

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The American Bell Telephone Company has obtained from Judge Wallace an injunction against the United States Telephone Company, representing the McDonough interests.

Mr. Charles W. Price, well known in the newspaper world in Kansas City, Topeka, and the West, though perhaps better known to the electrical fraternity through his correspondence published in this paper, and as one of the most successful telephone managers in the Northwest, will represent the *Review* for the West in future, with headquarters at Chicago.

The examiners of the different sections at the Electrical Exhibition in Philadelphia are getting their reports into shape. Ten reports have already been received by the governing body of the Franklin Institute, and will shortly appear, first, as supplements to the Journal of the Franklin Institute, and later as separate pamphlets. They will be sold at a nominal figure—from 10 to 25 cents each, according to size—and as soon as published, may be had by any one on application to the Institute, by mail or otherwise.

The legislature of Texas has passed an act making all telegraph companies within its borders common carriers for the receipt, transmission and delivery of all messages intended to be sent by wire, and by another law it has enacted as follows: "It shall be unlawful for any officer, operator or other employe of any telegraph company in this State to divulge or make known to any other person the contents of any private telegraphic message received or forwarded at any office of such company, except to the person to whom such message was directed, his agent or attorney. And any officer, operator or employe of such company violating the provisions of this article shall be punished by fine of not less than $10 nor more than $100." This endeavor on the part of the law-givers of Texas to protect and secure the privacy of messages is certainly laudable, but the penalty seems totally inadequate compared with the seriousness of the offence of divulging the contents of a private message entrusted to a telegraph company in good faith. In the case of business messages absolute privacy is often of the greatest possible importance, and any betrayal of its contents might result in very great and serious pecuniary damage to either the sender or receiver, or both. To divulge the contents of such a message would often be highly remunerative to an operator, remunerative to an extent which would make even the highest penalty above-named seem insignificant When a person invades the privacy of a letter sent by mail, imprisonment is the penalty, and very justly, and we cannot see why the privacy of a telegraphic message should not be as surely guarded. The payment of a fine is a matter of dollars and cents. Imprisonment is a matter of personal disgrace, and from this all men shrink.

QUARTERLY STATEMENTS.

To the Editors of the Electrical Review:

Many of your readers who are holders of telephone stocks consider the quarterly statements of different companies, which occasionally appear in your columns, one of the most important features of your paper. There are many, no doubt, who take it for its scientific information, but some of us do not know where to obtain reliable news respecting the condition of the companies in which we are interested except in the ELECTRICAL REVIEW, and take it mainly for that purpose. Can you not extend its usefulness and enterprise in this direction? Can you not obtain regularly, every quarter, from every telephone company, the earliest copy of its quarterly statement? Do not the companies owe it to their stockholders to keep them advised of the condition of their investments, and is there any better way than by publication in your paper?

STOCKHOLDER.

The above communication touches upon a point to which we have given much attention. Not only in the columns of the REVIEW, but also by circulars and personal letters, we have over and over again requested the officers of telephone, electric light, and all other electrical companies, to send us early copies of their quarterly, semi-annual, and annual statements, to the end that we might give them prompt publicity. In return, especially at the time our circular letter was issued, came a shower of promises, but of these, we regret to say, only a few have been kept. We now repeat our request, not only to telephone companies, but to electric light companies, and all other corporations doing an electric lighting business, to send to us, for publication, copies of any financial or other statements covering information which it is proper and right to submit to their stockholders, and we will at once insert it.

There is a feeling on the part of the officers of many companies that publicity as to the affairs of the companies over which they preside is injurious, and hence to be avoided. They forget that their organizations are *public* companies, chartered under laws made by the public; exercising privileges secured to them by the public; and that not only their stockholders, but the public at large, have a right to know, not the details of their business but its general condition and results, and that the law in all cases seeks to secure this to the public by requiring returns to be filed at stated intervals. Now, as it seems to us, it is much better to comply with the spirit as well as with the letter of the law, and to make up from the books, at stated intervals, say quarterly, an exact statement of assets and liabilities; not in minute detail, but in such a way as to give the general facts, and send it by mail to all stockholders. If, in addition to this, or even in lieu of this, as a means of saving expense, such statements be sent to us, we will gladly print them without charge.

Whether this shall or shall not be done, rests ultimately with the stockholders. They have a right to demand it, and if they demand it, it will be done. We trust that they will exercise their rights. Some may argue that the publication of an unfavorable statement might do injury to a company and to the market value of its stock. Possibly this is so, but it is certain that, in a majority of cases, the publication of *no* statement does infinitely more injury.

THE ELECTRIC LIGHT CONVENTION.

All the indications point to a very large gathering of electric light men at Chicago on Wednesday, next week. The favor with which the proposal to hold such a gathering has been received from the very beginning shows how much it is needed, and how desirous men, widely scattered but engaged in the same business, are to meet and confer with one another.

This being the first meeting of the kind ever held, it is of the utmost importance that it should proceed to its work with due deliberation and caution, and with an eye single to the good of the whole interest represented. If its force and energy be diverted into any other channel, if there should be any effort to *use* it for the benefit of any particular system, or for the advantage of any manufacturing interest, electrical or mechanical, nothing but injury could possibly result. It is not because we anticipate anything of the sort, or because there is any reason to suppose that anything of the kind is in contemplation that we say this, but it is because it is the best way to avoid the possibility of it, even, is to put all on their guard.

We are glad to note that the electrical people in Chicago have held a meeting, and appointed several committees to arrange certain preliminaries. This is courteous and hospitable, and will no doubt greatly expedite and facilitate the work of the convention, as well as the convenience and comfort of delegates What the convention will do, and how it will do it, the convention itself must decide, and it is to be hoped that it will have just as little of the "cut and dried" characteristics as possible. It is to be hoped, also, that the delegates will come prepared to remain long enough to consider carefully and execute with due deliberation the work in hand. While we do not presume to know how long it will take, not knowing what is to come up, we should presume that if the convention assembled at noon on Wednesday next, it could do but little more that afternoon than organize and appoint its several committees, and that, possibly, at an evening session some papers, previously prepared, might be read and discussed. On Thursday the convention ought to get down to its work in sober earnest, and, unless more matters come up than one would expect, it ought to finish up by Friday night, possibly not till noon on Saturday. Certainly delegates ought not to be expected to remain over Sunday. For eastern delegates, homeward bound, the Saturday evening trains will be very convenient, enabling them to reach New York and Boston, or neighboring points, early on Monday morning.

We are looking forward with no little pleasure to meeting the representative electric lighting men of the country. Many of them we have the pleasure of knowing personally; many more we know through correspondence, and pretty much all of them know us through our columns. We expect and intend to be careful and appreciative listeners to the proceedings, and make no doubt that we shall gather from the interchange of experiences among members, facts and suggestions which will be well worth reproducing in these columns for the information and benefit of all our readers.

The headquarters of the ELECTRICAL REVIEW will be established at the Grand Pacific. It is our hope that every delegate will favor us with a call, enter his name in our register, and call upon us for any information we can give and any service we can render.

The Triplex Insulated Wire.

For the past two years the Triplex Insulated Wire and Rubber Company of New York City has been quietly at work upon, and has succeeded in perfecting, a most complete and successful system of insulation for conductors of the electric current. The method of insulation and process is very rapid, and any degree of insulation can be applied.

Among the many claims of superiority of this system over others is its perfect quality of insulation, it being far above the average. Even the electric light wires can be handled in any weather, it is stated, without feeling the slightest indication of a current. This is an important factor in the transmission of currents to a distance, as is well known. Again, in actual, every-day service, the ease of manipulation of the wire has met with general approval among linemen. Its indifference to the effects of extreme temperatures is equally remarkable with its resistance against the corrosive action of the acids and salts usually met with in soils and in the atmosphere; most severe tests have been applied, and in every conceivable way for the purpose of attacking the material of the insulation, but without success. Further, it may readily be conceived that the more perfect the insulation in electric lighting, the steadier will be the service of the lamps, and, in addition, the greater the general economy of the plant.

One of the largest and most successful electric lighting companies has been making extensive tests with this system for some time past, and in corroboration of the claims set forth by the Triplex Company, their General Manager said in answer to our inquiries:

"We used, as near as I can now recollect, about 75,000 to 100,000 feet of their rubber-covered wire. Our experience, thus far, shows that the insulation is excellent. We like the way in which the wire handles by our workmen. It is more satisfactory than any other which we have had. We have not had any difficulty whatever with the wire thus far, although it is in places where it receives a very strong test of its durability. The sample of wire which I have had in salt water, with the current on for about ten months, is still as good as new.

It is stated that the Receivers of the Bankers and Merchants' Telegraph Company have been negotiating during the past few days with capitalists interested in the Postal Telegraph Company. It was stated by one of the Receivers that the negotiations had not been concluded, but there was a general understanding among telegraph men that the Postal Telegraph capitalists had agreed to advance the Receivers of the Bankers and Merchants' all the money they needed, and in consideration therefor the lines of the Bankers and Merchants' Company would be placed at the exclusive disposal of the Postal.

The scheme provides that Receivers' certificates shall be issued for whatever sums of money are advanced.

The Receivers of the embarrassed telegraph company say that they are making satisfactory progress in straightening out the company's tangled affairs. They have redeemed $3,000,000 of the bonds and are arranging to redeem $2,000,000 more, which will leave but $5,000,000 of bonded debt. The Receivers have also redeemed 4,700 shares of the stock of the Commercial Telegram Company, which is worth about $200,000.

Telegraph Companies—Erecting Poles—Damages—Injunction.

A telegraph company put up poles on the lands of A, who conveyed the lands to J. Two years after J. got title he gave the company notice to remove the poles, and on its refusal to take them down, he filed a bill for an injunction to restrain the continuance of the poles, alleging that they had been erected without his consent and against his will, and that notice to remove them had been given. The injunction was granted, and the company appealed to the Supreme Court of Alabama, where, in deciding the case—Western Union Telegraph Company *vs.* Judkins—the decree was reversed. The chief justice, in the opinion, said: "The defendant is a corporation having a right to take and appropriate lands for the construction of its telegraph lines The general rule is that a corporation having the right to take lands in the exercise of the power of eminent domain, if it enters upon them without making just compensation to the owner, a court of equity will intervene for the protection of the owner until just compensation is made, if he applies seasonably. But the application must be made seasonably. The right to relief is lost by laches in seeking the protection of the court. When the corporation constructed its lines over the lands now claimed by J is not shown by the bill, but it is shown that it was during the estate of his predecessor in title, and that more than two years elapsed after he, J, acquired title before he made any complaint of the wrongful taking of the lands. The laches of the complainant and his predecessor in title excluded him from the aid of the court by injunction. But the trespass upon the land was capable of full redress by legal remedies, and J should have proceeded in a court of law."

President Tyler of the Telephone Company is experimenting at his New Haven office with a new telephone attachment, called "The Dudley Teléphone Signal Individual Call and Secrecy Switch." As its name indicates, the object of the instrument is to give privacy in using the telephone. No one else on the circuit can break in or listen to the conversation. The subscriber who rings immediately converts the whole circuit into a private wire between himself and the central office. By the use of the Dudley signal the bell rings only when a subscriber is called, his calls to the central office not being accompanied by any ringing. The Dudley instrument is in a small blackwalnut box, similar in size and form to the box which encloses the telephone transmitter. It is placed beside the upper part of the call box, and is connected with the hook on which the hand-telephone hangs by a metal bar, which is thrown up by the spring when the hand-telephone is taken from the hook. The current passes through this box instead of the call bells, except when the bells are switched into the circuit at the central office, a subscriber's bell being switched in only when he is to be called. The transmitters are switched in and out in the same manner by pressing the subscriber's button on the switch-board at the central box, and can be seen through glass in the center of the front of the box, indicates whether the line is open for use. It is claimed that by means of the Dudley signal a central office can be dispensed with in places where the subscribers are few.

There is perhaps nothing that shows the effect of hard times in business circles so clearly as the business of a telephone exchange," remarked Angus Hibbard, the superintendent of the Wisconsin Telephone Company at Milwaukee recently. "Now, during the recent severe financial depression, our business through the State fell off considerable. When business is looking blue, and the merchant desires to retrench, he dispenses with his telephone. Why, in Omro, we lost every subscriber we had there. Lost the whole town. Now the tide seems to have turned in the direction of more prosperous times, and we are putting in telephones, instead of taking them out. Business must be getting brighter even in Omro, because we have received inquiries from several business men of that place as to whether they could have their telephones replaced, but at a reduced rate. During the past month we have put in 105 telephones throughout the State, including Milwaukee."

Southwestern Notes.

General Superintendent J. P. McKinstry, of the Erie Company, made Little Rock a visit on the 1st. He was met here by J. K. Dunbar, general superintendent of the southwestern division, and after visiting the exchange and spending Sunday, they left for Texas, and will make a general tour of the company's exchanges in that State. Mr. McKinstry is a very pleasant and sociable gentleman, and knows all about the telephone business, while they don't make any better superintendents than Mr. Dunbar.

The telephone business, like all others, is very quiet in the Toothpick State. But from what I read we are none ahead of or behind other sections of the country in that respect. Even in Texas things are dull. Still, we have managed to keep a full list so far, and even crawl ahead a little, and live in hopes of a good time coming. The last United States census gives Little Rock about 14,000 inhabitants. We claim upwards of 20,000. At least one-third are black, and the darkey is not a liberal patron of the telephone as yet. So I think 333 subscribers to the exchange here is not at all a bad showing.

Bi-Polar should not crow over his western genius and his magneto transmitter until it is an accomplished fact. I have one myself, only, unfortunately, it is all on paper yet. But I "just know it will work," and if Bi-Polar's man don't hurry up, I will get it out some day and set it to helloing. So look out for me. Talking of magneto receivers, and the blessing a successful one would be, with some telephone men a short time back, one of them characterized it as a "Utopian dream that would never be realized." But nothing seems impossible in an electrical way in these days. So I mean to wait and hope.

Those of your readers who have ever heard one of the diabolical catamount whistles that some of the western river steamers carry, will be able to appreciate the following "lineman's tale." He said: "We were building the Helena, Ark., exchange, and I was on a pole in front of an old Jew's store, near the river bank, when a big boat came down stream; and just as she got opposite, turned one of those mocking birds loose It was a regular daisy, and as she wound up with a screech on a top note fit to take the shingles off, out ran the Jew, and shaking his fist at me he howled: 'Mine Gott! Uf dose wires was make dot mooche noise, und only dose few oop, how in heel vas anybodys going to schleeps in dis town when you get 'em all oops.'"

Are you acquainted with the telephone subscriber who calls at the office on Wednesday, and raises a row because the operators do not know "who it was called him up and talked to him last Friday afternoon about half past five o'clock?" He was down here a few days ago and if you happen to meet him in your travels please give him my regards. A. F. A.

.... Most of the western railroads which have been benefited by land grant subsidies from the Government own and operate their own telegraph lines. There is a clause in each subsidy grant which prohibits the railroad company receiving such grant from giving to any other corporation or telegraph company exclusive telegraphic privileges. The Western Union Company, however, practically enjoys exclusive privileges in the use of the telegraph lines belonging to the Pacific railroads controlled by Jay Gould. The Baltimore and Ohio Telegraph Company has determined to contest the Western Union's right to keep its exclusive privileges. An application by letter was made by President D. H. Bates, of the Baltimore and Ohio Company, to the Union Pacific Railroad last August, asking for an exchange of telegraphic business at Kansas City with the Kansas Pacific and the Union Pacific railroad telegraph lines. Mr. Bates said he desired to open up those lines to the public through the Baltimore and Ohio as a competing line with the Western Union. He took the ground that the various acts incorporating the Union Pacific and the Kansas Pacific companies, and extending to them Government aid, contemplated the operation of the entire telegraph system of those roads, free of discrimination of every kind It is the desire of the Baltimore and Ohio Company to connect its own lines with the telegraph lines of the Union Pacific, Kansas Pacific, Missouri Pacific, Northern Pacific, and the Atchison, Topeka and Santa Fe railroads. Such connections would give to the Baltimore and Ohio the same facilities for reaching the Pacific coast as are now enjoyed by the Western Union Company. More than a dozen letters have passed between President Bates and Charles Francis Adams, Jr., President of the Union Pacific Railroad. After Mr. Bates had repeatedly requested a definite answer to the application of the Baltimore and Ohio Company, Mr. Adams replied as follows, on January 5:

"Our company will, at any place where it has an office for commercial telegraph business, receive from any person or corporation, including the corporation represented by you, any message offered to it, and transmit the same without discrimination of any kind, at the same rates and on the same terms as it does messages for any other person or corporation. I have not at hand the tariff of rates, but such tariff can be obtained by your company at any of our company's offices where it does telegraph business for the public. * * * This company will not make any contracts in respect of a general interchange of business involving the keeping of accounts for the business so exchanged."

President Bates wrote that such terms would be perfectly satisfactory to the Baltimore and Ohio Company, and in order that the necessary arrangements might be completed, he requested Mr. Adams to send him a list of the telegraphic stations on the line of the Kansas Pacific Road between Kansas City and Denver. There are said to be about 60 of those stations. After some delay, Mr. Adams replied that there was no list of the stations kept by the company, but that the stations were "well known." Thus the matter stands after five months of correspondence. The officers of the Baltimore and Ohio Telegraph Company suspect that the strong Western Union influence in the Union Pacific directory is accountable for the disinclination of the officers of the Union Pacific to enter into the arrangement proposed by the Baltimore and Ohio. The American Union Telegraph Company made a similar demand upon the Union Pacific Company about five years ago, when Mr. Gould was connected with the American Union. Ex-Judge Dillon, who was counsel for both the Western Union and Union Pacific companies, prepared an opinion, together with Sidney Bartlett, of Boston, setting forth that the Union Pacific Company was obliged under its charter to extend its telegraphic facilities to the public through any and all mediums without discrimination. The consolidation of the Western Union and the American Union soon followed.

The half-yearly meeting of the Direct Cable was held in London, last Monday, at the Cannon Street Hotel—Mr. John Pender, M. P., in the chair. The attendance was small. The report submitted shows a difference of about $25,000 in last half-year's receipts less than the corresponding half-year of the previous year, but the working expenses were $15,000 less, and a net profit of a quarter of a million dollars was reported. After the report was adopted, a dividend of five per cent. was declared. Mr. Pender then spoke He stated, in reference to reductions, that there was no doubt whatever that the real object of Messrs. Mackay and Bennett was to make money. He then, referring to press rates, added that the Commercial Cable Company was fully occupied, simply in transmitting press messages to Associated Press and all other correspondents, and also to the *Herald* and *Telegram*, at the rate of five pence per word, while the Direct Cable Company found plenty of commercial work at one shilling and eight pence per word. He said that he did not think that Messrs. Mackay and Bennett would be satisfied with a return of only two and one-half per cent. on their capital, and would soon find a remedy which would bring higher interest. He assured the shareholders that the fact that the direct cable was broken would not affect receipts very much, as all work was sent to the Anglo-American, and in reality they (the Direct Cable Company) were backed by all the old cable companies. He hoped that in a short time the broken cables would be repaired. The meeting was very quiet, but a stormy meeting is expected for the Anglo-American Company to-morrow. Field's friends will defend him, and declare him the American backbone of the cable company, and fitted by experience, repute and honor for any trust committed to him.

** Although glucose can be easily prepared from various amylaceous substances, all attempts to artificially produce saccharose or cane sugar have hitherto been unsuccessful, but it is now announced that the synthesis of saccharose has just been accomplished by Messrs. Aubert and Giraud, and it is naturally anticipated that the discovery may eventually be of vast importance to the sugar industry. The process contisted essentially in submitting amylaceous matter derived from the potato, after it has been converted into glucose in the usual manner, to the action of an electrin current equal to about 75 volts. The electrodes were immersed in the solution, and the current reversed from time to time. The reaction terminated in about two hours, and the finish was indicated by the liquid no longer giving the characteristic color with tincture of iodine or a precipitate with alcohol. The liquid was afterward defecated by means of lime, which was subsequently removed by carbonic anhydride, and the syrup was then decolorized and left to crystalile. The crystalized product upon analysis yielded 88.38 of saccharose, 1 per cent. of glucose, 3-67 per cent. of asb, and 6.95 per cent. of water; it was, therefore, far from being pure cane sugar. At present it has not been decided whether the reaction consists in the dehydration of glucose, the union of a molecule of dextrine with one of glucose or the hydration of dextrine.

—— The comparative experiments which have been made on board the man-of-war Colossus, at Portsmouth, England, were begun at seven in the morning on the 15th of January. The ship is lighted by the American Brush Company's system, and the three dynamos are driven by Brotherhood engines of 15 horse power each. The installation, which extends to every part of the ship, is said to be the most complete ever put into a man-of-war. The arc light, which is still in use on board the "Inflexible," was entirely cut out, and incandescent lamps of from 10 to 20 candle-power each were employed exclusively. It is believed that these tests will prove the economic advantages of the electric light; but, in any event, the superiority of electric lighting as to illumination and comfort is incontestable. The experiments were continued without interruption, day and night, until Jan. 22.

——The mines of Tirpentivy are now lighted exclusively by electricity, and so satisfactorily that it will probably be put into a number of mines in the neighborhood.

Telephonic News

*** Careful estimates show that there is in use on the Telephone, Telegraph, Electric Light, District Telegraph, and Fire Alarm Systems in this country something over twenty-five million glass insulators.

We were recently shown an entirely new thing in this line manufactured by the National Insulator Company of Boston. By the apparatus used in the manufacture of this insulator a perfect inside thread is obtained; it also does away with the present use of the wires, it having a gimlet-pointed screw top which by use of a clip makes itself binding. It has received the endorsement of many practical electricians in this country and Europe.

*** Discussing the matter of free telephoning, Capt. George Stone, of Cincinnati, says: "I have carefully estimated, and have found that 25 per cent. of the messages sent over our wires are from people who never pay a cent to the Bell Telephone Company." "That is, by the men who step into your customers' offices and borrow their telephones?" "Yes, by men who borrow telephones. Twenty-five per cent. seems like a large and liberal estimate, but I am convinced that it is not too great. In fact, some men don't seem to think anything more of borrowing a telephone than asking for a drink of water, though they would never dream of asking to have a telegraph dispatch sent free." "And is there no way to stop this borrowing and lending?" "We have discovered no way as yet, although our rules in regard to the matter are very rigid. Customers, however, are gradually beginning to see that it is a bad thing for themselves as well as for us."

*** We extract the following from the annual report of the Secretary of the Franklin Institute, Dr. Wahl: "In the fields of electrics, several subjects of interest may be noticed. The persistent agitation of the question of underground wires has caused the enactment of mandatory ordinances in a number of the principal cities of the country, requiring the wires to be placed under ground after a certain date. Thus far, however, no solution of the question seems to have been proposed which would meet the requirements of the situation in a simple and satisfactory manner to all concerned.

The present situation seems to be this: While the necessity of placing the wires in the cities under ground is acknowledged to be growing more and more imperative, the problem of introducing the desired reform without imposing serious inconvenience and heavy pecuniary penalties upon the electrical interests, is likewise becoming more difficult to solve. Although some progress in the right direction seems to have been made in New York, Philadelphia, Chicago, Boston and other cities, in every instance, I believe, it has been found necessary to extend the limit of time in the ordinances above referred to.

Arc lighting seems to be steadily growing in popularity for the illumination of streets and other large areas. During the past year a careful series of experiments have been made under government direction to determine its practical value for lighthouse purposes. The incandescent lamp, also, has fully demonstrated its value as a means of interior lighting and its use is steadily extending.

Substantial advance appears to have been made in perfecting the working details of the multiplex-synchronous system of telegraphy (referred to in my last year's summary), a line of which has been in operation the greater portion of the past year between Boston and Providence.

The final settlement in favor of the Bell Company of the long pending litigation involving the ownership of the telephone, was one of the notable events of the year. The hope is very generally expressed that the removal of this distracting element will have as one of its immediate results the increase and improvement of telephonic facilities. The promise is held out that long distance telephoning will receive the immediate attention of the Bell Company, and the present year may witness the establishment of telephonic intercourse on a practical basis between a number of the seaboard cities.

In the direction of the electric transmission of power it does not appear that any notable advance was made during the past year.

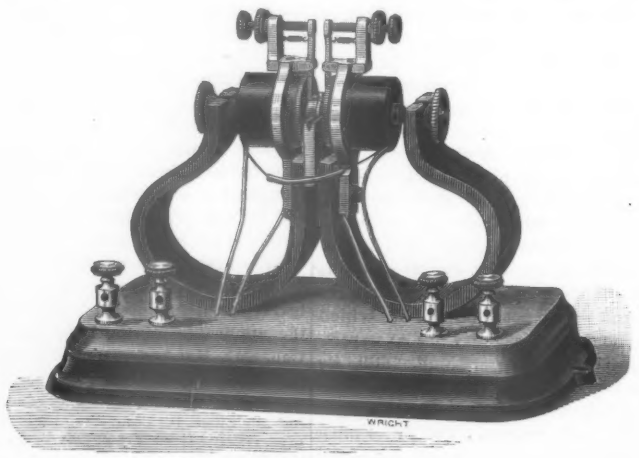
Of special interest in this connection was the International Electrical Exhibition held in Philadelphia in the autumn of 1884, under the auspices of this Institute, and which afforded an excellent opportunity for the illustration of the most recent advances in the applications of electricity.

* * At a recent meeting of the Academie des Sciences, Paris, M. Hermite presented a paper by M. P. Duhem on this subject, in which he demonstrates that—1, all forces not dependent on distance are annihilated; 2, all action which depends on distance has an infinitely small resultant; and 3, elementary couples are constituted so as to give to the end of each element of length of the conductor a force of the same order as the element, and a finite force at the points where the form of conductor presents a singularity.

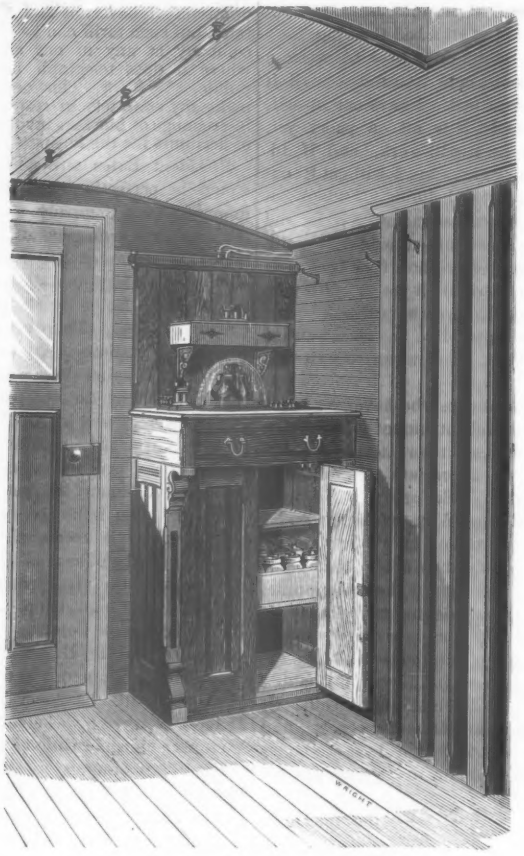
TELEGRAPHY ON A MOVING RAILWAY TRAIN.

EXPERIMENTS WITH THE PHELPS' INDUCTION SYSTEM.

On the afternoon of the 13th inst, three special cars left the Grand Central Depot over the New York and New Haven Railroad filled with electricians, engineers, and railroad men, with the object of witnessing the operation of the newly-invented system of railway telegraphy of the Phelps' Induction Telegraph Company, by means of which telegraphic communication is to be had at any time between a moving train and any station on the line. Among those present may be mentioned: Professors H. W. Morton, A. K. Eaton, D. H. Bates, Superintendent of the Baltimore and Ohio Railroad Company; S. S. Bogert, C. W. Bradley, C. D. Gerham of the West Shore Railroad, F. K. Hain of the Manhattan Elevated Railroad, Joseph S. Spinney of the Mexican Central Railroad, J. A. Barrett, Colonel Robert Oliphant, George B. Sennett, and William H. Stephenson, Superintendent of the Port Morris Branch of the N. Y., N. H. and H. R. R., on which the experiments took place.



RELAY ON CAR.



INSTRUMENTS IN BAGGAGE CAR.

The general principle on which this system acts is simply that of dynamic induction. If the current flowing in a primary circuit be broken whilst a portion of another metallic closed circuit lies parallel to it, a momentary current will be produced by inductive action in this secondary circuit, and its flow will be in the same direction as that of the inducing current; again, if the primary circuit be closed, a momentary current will be induced in the secondary circuit, but this time in the opposite direction to that of the inducing current.

In this system of telegraphy a wire conductor laid between the rails constitutes the primary circuit, and the secondary circuit consists of a wire circuit which passes along the ceiling of the car, thence down and under the body parallel to and within about seven inches of the primary wire; it joins the upper end and thus forms a closed circuit; by means of these two circuits and an auxiliary local battery circuit on the train, the messages are received and transmitted.

The main line conductor is secured and protected upon the track in the following manner: Blocks of wood are first nailed upon the ties midway between the rails. These blocks are so "graded" that when they are in place their upper surfaces will be on a level with the top of the rails. When the blocks are in place string pieces, two inches square with a groove in the top, are nailed upon them; the groove contains the wire, which in the present case is a No. 12 American Gauge insulated wire; and when this is in place, a cover of wood three-eighth of an inch thick is nailed down, and over the joints a strip of galvanized wire two inches wide is securely nailed. At switches and crossings, where a rail crosses the track, the grooved strips are brought up to the rail on both sides and the wire carried under it in a stout rubber tube. The ends of this tube are carried up into the boxes and along inside for a short distance as a protection against dampness and injury. At highway crossings a groove is cut in the planking of sufficient size to receive a half inch gas pipe instead of the boxing; the pipe is fastened down with staples and the wire passed through. In the equipment of the car, as the whole system depends upon the induction between parallel wires, it is self-evident that it is desirable to have the wires parallel for as long a distance as possible. In the present case a two inch gas pipe is suspended seven inches above the track.

This pipe contains a one and a quarter inch rubber hose, incased in which are 90 convolutions of No. 14 (A.G.) copper wire, single braided and paraffined, and so connected as to form one continuous circuit about a mile and one-half long, and presenting about three-quarters of a mile of wire parallel with the primary line wire between the tracks. The return portion of this coil is carried in the same rubber hose back through the upper part of the car, the object being to have it removed as far as possible from the lower branch. The terminals of this car circuit are carried to a key for transmitting, and through the back contact of the key to a very delicate polarized relay, invented by Mr. Phelps; this is the receiving instrument upon the car and responds to every reversal of the polarity of the current over the primary or line wire.

A sounder situated upon an elevated sounding box is actuated by the relay in the ordinary manner.

The transmission from the car is effected in the following manner: The battery upon the car consists of only five one quart battery cells. One of these cells is used to actuate the local sounder and the other four for transmission. The current from these four cells is passed through the front contact of the key before mentioned, through the mile and a half coil, and through a "buzzer" which serves to break the current very rapidly and to cause a humming like that of a bee. This buzzing is broken up into Morse characters by the key and received in a telephone at the terminal station.

In transmitting from the terminal station to the car a battery is used which will give a current of about one and one-half amperes over the line, and manipulated by a pole changing key of special form—also the invention of Mr. Phelps.

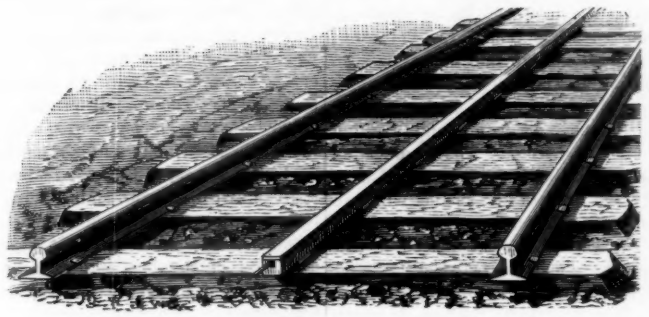
The plant which was used for this test and which has been in successful operation for the past two weeks, comprises twelve miles

of track, of which three miles are trestle work. There are two rivers with drawbridges, one requiring 110 feet of cable and the other 175 feet of cable. The wire is carried underneath the iron rails in twenty-six places.

There are forty-seven highway crossings where the wire is carried in an iron pipe. At Harlem River Station the wire is returned upon two side tracks, and at New Rochelle it is carried for about half a mile upon poles. The day was quite unpleasant, a heavy snow storm prevailing all the afternoon. This, however, seemed to have not the slightest effect upon the inductive action of the primary current, for during the entire test a current of very satisfactory strength exhibited itself in the secondary circuit. Whilst it is impossible to speak of the experiment as an *unqualified* success, the failure to attain it was due, not in the least to fault by principle, but to defective minor detail, the remedy for which is no doubt already at hand. Suffice it to say that words were distinctly transmitted to and fro, whilst the train was running at a speed of not less than twenty-five miles an hour! It is not necessary to dwell upon the great benefits to be derived from this invention when they are self evident and it would seem safe to predict a very brilliant future for this system of railway telegraphy.

This plant will continue in practical operation until further notice on trains departing from Harlem River at 11.55 A.M. to 2.10 P.M., and electricians, engineers, etc., interested, will be furnished transportation to examine it working.

The management of the telephone system in St. Paul has recently been placed in charge of Manager Palmer of the Minneapolis exchange, and the business of both offices is hereafter to be conducted under the supervision of that gentleman. Mr. Reynolds, the late manager in St. Paul, has been appointed superintendent of construction for all the exchanges and lines located in Minnesota. The salaries of all the male employes of the clerical and construction forces in both cities were cut down Feb. 1, the reduction being $10 and $15, according to the compensation previously received. Manager Palmer states that the pay of lady clerks and of the operators had not been touched, and that he had received no orders to make any reductions in those directions. He says he regards the cuts which had been made as merely temporary, and believed full pay would be restored in the spring. It was merely a stroke of economy, such as many corporations had adopted at the opening of the new year. The cut had been generally accepted by the employes.

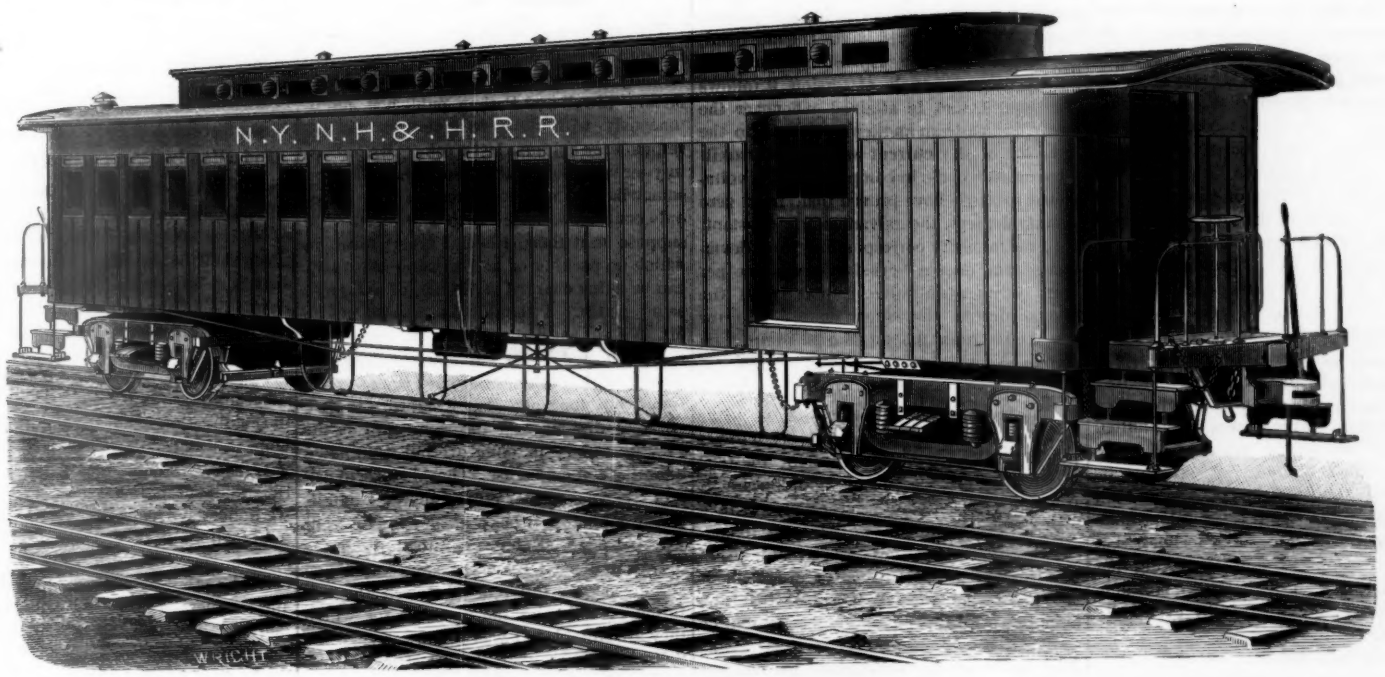


LINE CONDUCTOR.

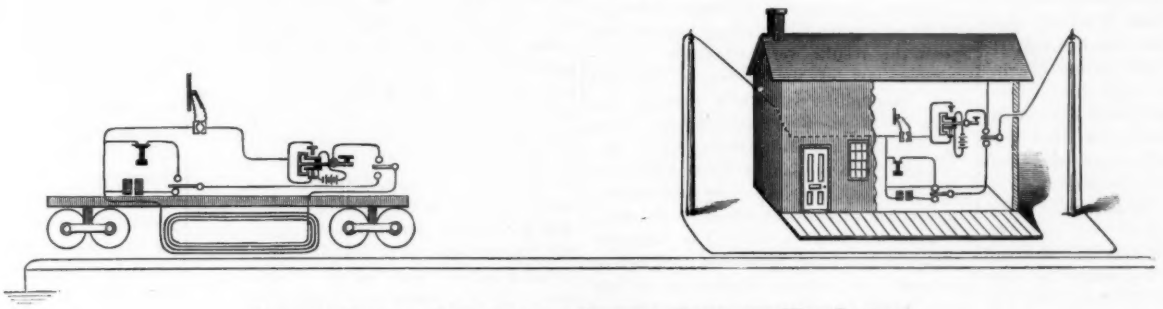
The resistance of carbon points in contact to the passage of electricity is a subject of a mysterious nature, and one which derives a peculiar interest from the action of the microphone. Mr. Shellford Bidwell has undertaken a great many experiments to investigate the matter, and the results of these have been brought by Professor W. G. Adams before the Royal Society. The apparatus employed by him consisted of a light steel rod or lever balanced by a knife edge carrying a scale-pan near one end and a counterweight near the other. The end carrying the scale-pan was allowed to rest on two pieces of electric light carbon laid one over the other, so as to form a contact between them, across which the current from a battery could travel. The scale-pan was fixed half way between the bearing end of the lever and the pivot, so that any weight put into it was just double the pressure on the contact. With this and similar arrangements Mr. Bidwell made many measurements which we need not specify. The general results arrived at by him are both interesting and novel. He finds that when the pressure of the contact is comparatively small (say, from 0 to 2 grammes) slight changes of pressure produce great changes of resistance (say, from 15 to 5 ohms) as compared with the changes which take place when the pressures are comparatively high, say, 10 to 50 grammes. The change of resistance due to change of pressure is also proportionately greater with weak currents than with strong ones. Changes of current produced proportionately greater changes of resistance with small currents than with large ones, and with light pressures than with heavy pressures. When the resistance of a carbon contact has been reduced by an increase of pressure, it will, on the removal of that pressure, rise to nearly its old value. A very curious result is, that within certain limits depending upon pressure, the passage of a current causes a permanent diminution in the resistance, and the stronger the current the greater will be such diminution; but when the strength of the current exceeds a certain limit, the resistance is greatly and permanently increased. The greater the pressure the higher is such limit. Mr. Bidwell also shows that the fall of a resistance attending increased pressure is greater than that due to increased pressure alone, and is partly due to increased strength of current. He does not consider it proved that the diminished resistance of the contacts under pressure is an effect of temperature. With metal contacts, Mr. Bidwell finds that the weaker the current the higher the resistance, keeping the pressure fixed. Increase in the strength of current diminishes the resistance, but on reducing the current again the resistance does not proportionately rise as in the case of carbon. If the metal is clean there will be a slight fall; but if it is dirty there will be a rise. The fall of resistance due to pressure is greatest with small pressures and weak currents. For these and other reasons, such as the fusing of the metal points, Mr. Bidwell does not consider metals adapted for transmitting speech.

.... There was a rumor sent here from Chicago that the Western Union had been interesting itself in the affairs of the Bankers and Merchants' Telegraph Company, and was considering some arrangement by which competition could be reduced and the Bankers and Merchants' be enabled to meet its running expenses, and possibly something more. Mr. Gould was asked if there was any foundation for the rumor. He said: "I do not think there is. I do not know of any, for the Western Union has no use for highway lines. No, I don't think the Western Union has any occasion to trade with the Bankers and Merchants'." With respect to a rumor that it was intended to open a transfer office for Western Union in Philadelphia, Mr. Gould said that the matter had been considered, but it was as yet undetermined. "In case it should be decided upon, would arrangements be made for the transfer of Union Pacific and other securities with which you are connected?" "That is quite possible, and it may be settled upon very soon," he replied.

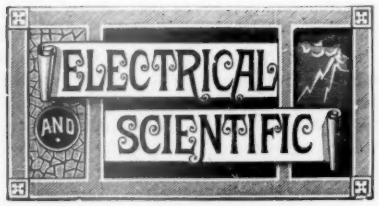
.... The International Telegraph Congress at Berlin, which was to have been held at the beginning of the present year, is postponed to 10th of August, 1885. Official invitations will be issued to all who took part in the St. Petersburg meeting.



GENERAL VIEW OF EXTERIOR ARRANGEMENT.



GENERAL PLAN OF COMMUNICATION BETWEEN TRAIN AND WAY STATION.



* * As 5,872 patents have already been issued on applications of electricity, it appears that inventive genius is devoting much attention to that most mysterious force. An interesting announcement from the Patent Office last week was that of the confirmation of the priority of the Field electric motor patents as contested by Siemens.

* * Mr. Levison suggests that aluminium, which may now be beaten out into sheets as easily as gold or silver, be used for lining Leyden jars, the sheets being, of course, thicker than the tinfoil now employed For an equal surface it would not cost more, would be lighter, and would retain its brilliancy. Fifty sheets of aluminium foil, 4 square inches in surface and of the suitable thickness, would cost about 4 s.

* * Writing to the *Engineer* on electric light cables, Mr. J. Johnstone, of Edinburgh, mentions the galvanic action set up by natural process between the metallic bases of earths and metals. He says that his attention was first drawn to the subject upward of forty years ago, when he saw an iron water main lifted out of a street in Greenock, where it had lain in a small bed of sand crossing the line of the street. At this part the outside of the pipe was covered with nodules, which were conglomerates of sand and oxide of iron. Inside the pipe, opposite to each of the exterior nodules, was a corresponding nodule of oxide of iron. These interior nodules were shaped like those found in cavities of hematite. It was therefore assumed by Mr. Johnstone that the inner nodules were formed as a result of galvanic action, which was transmitted through the body of the metal of the pipe from the nodules of sand and oxide on its exterior. Mr. Johnstone has never seen sand similarly adhering to lead pipes unless there was also lime in the sand. He considers that galvanic action fully explains the pitting that takes place in iron pipes that have lain long in sand, and which are thereby eventually destroyed.

* * M. Marcel Deprez, the eminent electrician, recently brought some interesting experiments on friction before the French Academy of Sciences, and M. G. A. Hirn has since drawn attention to the fact that M. Deprez's results agree with certain conclusions arrived at by him some thirty years ago, and published in the *Bulletin de la Société Industrielle*, of Mullhouse, 1855. As these conclusions appear to have been overlooked, M. Hirn again formulates them as follows: 1 There is a remarkable difference between the friction of two pieces on each other when the surfaces are dry and when the surfaces are lubricated by some unctuous matter or air. 2. With dry surfaces the co-efficient of friction is independent of speed, surface, and load. 3. With lubricated surfaces the friction is always a function of the speed, load, and extent of surface contact. 4. The value of the co-efficient in the latter case depends on the quantity of lubricator, the temperature, and the nature of the motion, etc., but, 5. In ordinary cases the effort necessary to overcome the resistance is proportional to the square roots of the surfaces in contact, the square roots of the load pressing them together, and (when the lubricator is abundant) to the speed. 6. With high speeds, or at least when the loads are small relatively to the extent of gliding surfaces, many substances can be used as lubricators. Air under certain circumstances and in sufficient quantity becomes the best lubricator, the co-efficient then falling to $\frac{1}{10,000}$. When on the contrary the speed is low or the charges relatively great, the oily matter may be expelled and lose its effect, the coefficient rising to from $\frac{1}{100}$ to $\frac{2}{10}$.

* * London *Electrician* says that in the Deprez and D'Arsonval galvanometer for movable circuit there is only proportionality between the intensities and the deviations when an angle of four or nine degrees is not exceeded. So that it is always necessary to resort to the mirror when using this instrument; and that is not always convenient, especially in applications of an industrial character. M. Marcel Deprez, in seeking to construct apparatus for electrical measurements, at once simple, correct and of speedy application, has modified the original galvanometer so as to render the deviations exactly proportional to the intensities, even when they attain sixty degrees on each side of zero, which permits of using an index fixed to the movable frame, and working above a graduated sector. The modification made in the original instrument consists in providing the arms of the magnet with two pieces of iron, forming between them a cylindrical recess in which is placed the soft iron cylinder. The space between the latter and the two polar pieces forms an intense magnetic field, practically uniform, in which the frame moves. Whatever be its position within the above-mentioned limits, the couple due to the current is always proportional to its intensity; as, on the one hand, the couple due to the suspension wires is proportional to the angle of torsion, it follows that equilibrium is attained whenever the frame has made an angle proportional to the intensity of the current which traverses it. Experiments made in comparison with voltametric methods have proved that, from zero to sixty degrees, the galvanometric constant, *i. e.*, the intensity corresponding to a deviation of one degree, varied by about one per cent. of its mean value, a quantity of the same order as the other causes of error inseparable from the method of comparison employed.

* * The prospect of future laurels to be gained by M. Eiffel in constructing a tower 1,000 feet high as a monument of the 1889 Exhibition, has roused the ambition of M. Bourdais, architect to the Trocadero. Eclipsing M. Eiffel's designs, he proposes to construct a tower of masonry 1,000 feet high, to be surmounted by an iron structure of about 230 feet in height. It is stated that the chief object of this strange edifice would be to light Paris by electricity; if so M. Bourdais has scarcely considered his subject properly. An attempt at lighting in this way was made some time since in France, the summit of the tower of Rouen Cathedral serving as a point for diffusion, but very disappointing results were obtained. The inexorable law of the squares of distances would demand the fixing of a miniature sun on the top of M. Bourdais' column, before anything like a useful light could be distributed. This method of lighting has been tried in several American cities with relative success, but of course the heights employed are comparatively small. The Bourdais' monument would be erected in the Place du Carrousel, and besides serving as a light tower would be employed for many kinds of experiments, such as those connected with falling bodies, and would be used on a limited scale as an aeropathic establishment, an idea, which, by the way, is not a novel one. As to the lighting it would consist of a series of parallel beams thrown upon a number of mirrors placed in different parts of Paris, and distributed by them, something on the Jasper system. It is almost needless to say that this scheme will scarcely receive any serious support.

* * It is no unusual matter to find that inventions of importance have been anticipated by earlier investigators, who, through lack of applicability, have been forced to abandon their projects. It is the same story with electric locomotion; numerous models of locomotives were built and operated, but the cost of producing the electricity by battery, together with other faults, left the undertaking in the realm of experiments. Mr. Thomas Hall, of Boston, made a locomotive nearly thirty-five years ago, which first appeared in Palmer and Hall's catalogue of 1850. The engine which it represented was on the principle of a Page magnet, an electro-magnet revolving between the poles of a permanent magnet. The armature had a worm on its shaft which matched into a gear attached to the driving wheels, the latter being insulated by ivory. The track was laid in 5-foot sections, and was about forty feet long and five inches wide. Under the platform of the car was a pole-changer attached to a lever; when the engine reached the end of the track, it ran against an inclined plane, which reversed the pole-changer and sent the engine to the other end of the track, where the same thing was repeated; thus the engine was sent automatically from one end to the other. The current, produced by two Grove cells, was conveyed to the engine by the rails. Mr. Hall also in 1852 made for Dr. A. L. Henderson, of Buffalo, a model line of railroad, with electric engine, with depots, telegraph line and electric railroad signals, together with a figure operating the signals at each end of the line automatically. This was the first model of railroad signals or trains worked by telegraph signals.

Secondary Batteries.

The following letter from Mr. F. Geere Howard appeared in London *Engineering* recently. The letters from Mr. Sellon and Messrs. Elwell and Parker, published simultaneously with it, were given in our correspondence columns last week: "Mr. Sellon, in your last issue, makes use of the following somewhat remarkable expression: 'It is not only contrary to fact, but to *common sense*, to suppose that their (Elwell-Parker) form, in which no packing of active material is used, can be either charged or discharged as rapidly as my plates.' I should like to point out to Mr. Sellon that he is entirely in error upon this point, and, if he had experimented *personally* with both forms, he would have found out long ago that his form of plate will not discharge at the same rate as the 'Planté' type, in spite of that 'unknown quantity' common sense. That his form of cell will receive a greater rate of charge I admit, and it is because it has a greater thickness of working material; but the rate of discharge does not depend upon the same conditions, and hence the difference between the two forms of cells and the purposes for which they are suitable. I was not aware, as Mr. Sellon surmises, that the Electrical Power Storage Company had a special construction of cell in hand for use as a regulator, but should doubt its being cheaper than thin cast lead plates; possibly it might be less bulky, but of this I can say nothing, not having had the advantage of seeing it. At any rate, it would be interesting to know whether the company employs in this new form their system of packing in active material or plain lead only. If the former method be still used, the cost, I should think, cannot be less; but if the latter be adopted, how will it reconcile Mr. Sellon's remarks about the higher discharge of his plates, as I take it that a battery, to act as an efficient regulator, requires, practically speaking, no storage capacity, but very high discharging qualities. The suggestion of both manufacturers to have their cells tested by an independent authority is a good one, and the results thus obtained would be very interesting, indeed, to electricians, but I am afraid will not take place, as the experiments, to be of any use, should be extended over some months at least."

The Regenerative Accumulator.

London Engineering gives the following description of this accumulator: "M. Zenger's 'regenerative accumulator' is formed by surrounding the electrode forming the positive pole with a halogen, such as bromine, chlorine, or iodine. These halogens serve to depolarize the electrode in combining, when the circuit is closed, with the hydrogen upon the cathode. M. Zenger uses bromine because of its comparative cheapness and fluidity, rendering it preferable to gaseous chlorine and hydrate of chlorine, which are very unstable, or to iodine, which is costly and of a solid consistency. The bromine is placed at the bottom of a porous vase filled with fragments of retort carbon, and closed by a covering of paraffin furnished with a cork hole to insert the liquid bromine. A layer of chloride of iron is placed over the carbon, and the zinc plate is surrounded with a solution of dilute chlorhydric acid (1 to 10) mixed with 5 per cent. of glycerine to reduce the resistance of the zinc-carbon bromine cell. A very constant battery for telegraphic work, where the line has a considerable resistance, is obtained from a concentrated solution of chloride of iron, more or less diluted. In this way a hydro electric battery of 1.95 volts electromotive force and 0 5 to 5.2 ohms internal resistance is obtained, which gives 3.9 to 0 38 amperes according to its resistance. The constancy of the pile is considerable, and the cell can be regenerated in a short time by the current from a dynamo, which effects the reduction of the bromine. When zinc is once deposited on the cathode, and bromine on the anode, the current takes nearly a year to fall to one-third of its original intensity. There is no need to touch the accumulator while it is being charged, not to put water into it, for the hygroscopic power of the chloride of zinc and iron and the glycerine forbid considerable loss of water, and the diaphragm being closed there is no occasion to fear the loss of bromine."

Incandescent Lamps of the Sun Electric and Illuminating Company of Boston.

One of the most important *desiderata* in an incandescent lighting system is a filament of such a character that, while the light given shall be intense, yet that that result shall not be attained by a sacrifice of the durability of the lamp, and that the disintegrating action of the current upon it shall be reduced to a minimum.

This Company appears to have succeeded in attaining a high standard of excellence in the direction of the length of life of their lamp without affecting the light given, which is, although very white, at the same time mild and pleasant to the eye. Its lamps, we understand, have an average life of 1000 hours, although they frequently realize over 2,000 hours; this result being mainly due, of course, to the material used for the filament and the method of manipulation and manufacture. The construction of the lamp and the mode of connecting the filament with the leading-in wires are both very simple and effective.

Excellent results were given by the "Sun" lamps at the late Electrical Exhibition in Boston, not one lamp having given out during the whole of the Exhibition.

The method of operating the lamps was somewhat of a new departure, the dynamo used having been the *Arago*, which has an E. M F. of some 600 volts, and a current of 18 ampéres. The circuits were run on the series-multiple plan, there being arranged in parallel five of the 150 candle-power lamps (or 15 of the company's ordinary 16 candle-power lamps), and five of these parallels in series, thus giving 20 large lamps and 15 small ones without taxing the machine to its full capacity.

The Company is now making a specialty of these large lamps, and their economy and illuminating power augur well for the future of incandescent lighting.

The principle of the operation, by electrolytic action, of a hydrostatic float, actuating mechanism, seems to have been successfully applied in the electric meter of the Company, and the device used reflects great credit upon the inventor, being remarkably simple, and apparently accurate and reliable.

It consists, briefly, in one form of an ordinary cell containing a metallic solution, one electrode is conveniently attached to the cover of the cell, the other to a hydrometer immersed in the solution. To the top of the hydrometer, outside the cell, is attached a light finger which indicates on a simple scale, or by a hand, on a dial, the rise and fall of the instrument due to the change in

weight produced in the electrode by the electrolytic action in the cell. To avoid any error by reason of evaporation of the solution, the dial or scale is also made to float on its surface and accommodate itself to change in the quantity of liquid, but will, of course, preserve its relative position to the hydrometer-electrode, being unaffected by the change in weight caused therein by the electrolytic action.

*** Our London contemporary, *Invention and Inventors' Mart*, has the following to say on long-distance telephony in Europe: "The establishment of telephonic communication between Rouen and Havre, by means of the Van Rysselberghe system, has again directed attention to the queston of long-distance telephony. Although experments with this system of telephonic communication have been fairly successful in Belgium, and latterly between Rouen and Havre, it is quite clear that the ordinary telegraph wires will not do for telephone messages where the distance exceeds fifty miles. For short distances the system invented by Messrs. Van Rysselberghe and Herz is very economical, as telegraphic and telephone messages can be sent simultaneously, but it does not solve the problem. The reason is not far to seek, and it is one which opens a vast prospect for improvements to inventors. Until now inventors have chiefly worked against induction, without devoting sufficient attention to the electrical resistance of the conductors. This is, however, a subject, the importance of which is proved by recent events in the United States. The line of telephone between New York and Boston is by far the longest in existence on which telephonic messages can be regularly forwarded. The length of this line is 480 kilometers, although the direct distance between the two cities is only 320 kilometers. Notwithstanding this great distance, conversation is distinctly audible. However, the metallic telephonic circuit entirely consists of hard copper wire, of 2.79 millimeters diameter, and an electrical resistance of only 2.8 ohms per kilometer. The total resistance of the double line is therefore about 2690 ohms, so that, if American electricians had worked with ordinary telegraph wire, the transmitting distance would have had to be reduced to about 130 kilometers. The Americans have, therefore, theoretically solved the problem of long-distance telephony, but the question is less advanced from a commercial point of view. With so heavy a cost of erection of thick copper wire, the service can hardly be remunerative. The Bell Company has already erected a second line of 50 kilometers between New York and New Haven, and is establishing two others, but the commercial point has yet to be cleared up. The experiments in New York are, moreover, not the only ones out of this country which can serve as guides as to the limit of resistance of the conductor beyond which telephonic communication cannot be carried on. During the experiments made last year on the Paris underground system, telephonic messages were sent on a metallic circuit for a distance of 37 kilometers corresponding with 2,000 ohms. Other experiments carried out on an entirely metallic circuit, from Paris to Orleans via Essonnes, have proved the possibility of telephoning over a distance of 134 kilometers, with Ader, Edison, Blake, Hunnings and Berthon transmitters, the latter two being found somewhat superior to the others. The line consisted of telegraph wire of 4 and 5.3 ohms per kilometer. It is therefore clear that the use of wire with little resistance has everywhere been attended with better results than any other system. In this country the double-twisted wire system works under very good conditions between London and Brighton. The line is about 96 kilometers long, and consists of two galvanized iron wires of an electrical resistance of 6.25 ohms per kilometer. Blake transmitters and Bell receivers are used. This system demands the construction of a line of special and somewhat complicated construction, but it is as yet in Europe that which best transmits speech for long distances, and is about being introduced between London, Northampton, Oxford and Birmingham. There is, however, a considerable field for invention in the matter of improvements, both in conductors and apparatus. As to the Van Rysselberghe system, it will be seen from the foregoing, that it possesses by no means the importance attributed to it. In fact, the experiments carried on in France have not come so near the solution of the problem as those carried on in the United States and this country. French inventors have chiefly tried to utilize telegraph wires at the expense of the clearness of transmission. We may here state that amongst the inventors engaged in devising improvements, Prof Bell is one of the most active. He is busily engaged trying all sorts of schemes to make long-distance telephony a practical success in every-day working. He believes that in time it will be as easy for a subscriber in New York to talk to another in San Francisco as it is at present to "call up" one in Brooklyn or at the other end of the Island; but he thinks that it will be absolutely necessary to put all wires under ground, where they run through towns at any rate, for the efficiency of any system cannot be properly tested when the wires are carried by posts on buildings. The telephone will have an important place in the future of the telegraph service, but it can never altogther supplant the old telegraph until some means is discovered of making it automatically record its messages. Highly improbable as that may seem, it is not impossible; and when the patents that block the way expire in 1891, it is not unlikely that several inventos will be ready to give us a tolerably perfect telephone service."

The New Orleans Gas Company caught the city authorities in a tight place, and held them firmly in their grip. For several weeks the City Council was unable to come to terms with the gas company about lighting the lamps in the public streets. An ordinance was passed authorizing the Mayor to contract with the gaslight company to light the streets and public places for the year 1885, comprising 2,603 lamps, at $18 each, the light to be of not less than 11 candle power. This was subsequently amended so as to permit the city to reduce the number of lamps at a corresponding reduction of price, on account of the lighting of principal thoroughfares by electricity. This the gas company refused to agree to. Meantime the lamps have been lighted as usual. The company awaited their time, and at last served a formal notice on the Mayor that if no satisfactory agreement for the public lighting of the city of New Orleans during the year 1885 had been made between the city of New Orleans and the New Orleans Gaslight Company, at or before 12 M. Saturday, 14th February, 1885, and if no security had been given that the payment of the service rendered since the expiration of the last contract would be provided for, the supply of gas to the street, market, and square lamps, would be discontinued on Saturday, February 14, 1885. This was a proposition to darken the public streets on the eve of the carnival festivities, when 100,000 strangers were in the city, and of course the company having no competition in the gas business, the Council was at once brought to terms and the company obtained all they demanded. Thus the gas company, by taking advantage of the necessities of the city and the people, gained a temporary advantage, but it gained it at the loss of friends, and stirred up great and well-warranted indignation against itself. We shall be surprised, if, in the long run, it is not the loser by this trick.

*** The progress of the telephone in Great Britain is indicated by the number of subscribers to the five principal telephone companies on January 1st, which amounts to 12,197. Of these, 4,143 are subscribers to the United Telephone Company, 3,375 in London, 289 of the special Stock Exchange service, 136 in Brighton, 42 in Norwich and Ipswich, and 301 in Bristol; 2,804 of the Lancashire and Cheshire; 4,364 of the National; 272 of the Northern District Telephone Companies; and 614 of the Telephone Company of Ireland.

Rogers' Arc Lamp.

London *Engineering* gives us the following description of the arc lamp of Mr. Francis M. Rogers, a clutch lamp of simple and novel action; the working of the clutch being based on the link motion of a parallel ruler. Fig. 1 illustrates the general form of the lamp, and Fig. 2 the details of the clutch. The current enters by the terminal *A* (Fig. 1) and after passing through the solenoid *B*, traverses the upper carbon *C* and the lower carbon *D*, then leaves the lamp by the terminal *E*. A soft iron core *F*, carrying the stem or holder of the upper carbon *C*, is pulled up into the hollow of the solenoid, and thereby strikes the arc. Near its lower end the core *F* is formed square, and one-half of it, *G*, is cut out but attached to the rest, by four straight links *H*, two of which are shown in Fig. 2. When the core is lifted by the current, the linked half *G* drops down upon the stem and clips it securely, thereby holding the latter in place When, however, the arc lengthens, and the current

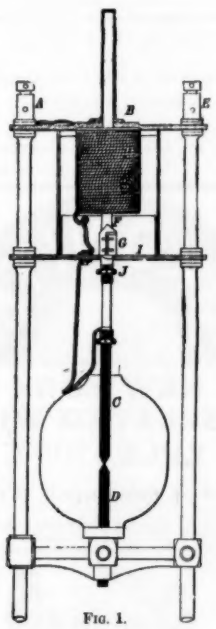


Fig. 1.

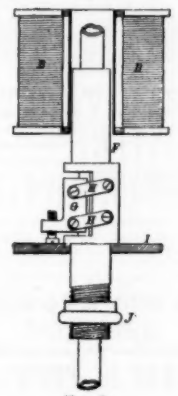


Fig. 2.

Rogers' Arc Lamp.

is weakened in the solenoid, the core drops, and the clutch *G*, touching the plate *I*, releases the stem and shortens the arc. The lower end of the core is fitted with a screw-nut, *J*, by which the normal length of the arc is adjusted. The clutch *G*, having a considerable gripping surface, acts as a brake upon the stem, without scoring it. This clutch is applicable to most electric arc lamps with a little modification of the latter; and Mr. Rogers has also constructed a shunt lamp in which the solenoid *B* is wound with fine wire, and placed in a shunt circuit with the arc; while a second solenoid of low resistance is placed in the main circuit and serves to strike the arc. The lamp has been in use for several months past, and is found to work very steadily. It has, in fact, been employed for color testing and photography, its simplicity of action, and freedom from derangement, causing it to be very easily managed.

ELECTRIC LIGHT NEWS

—— The Electrical Exhibition at the Paris Observatory will take place on March 19th.

—— The first application of the electric light at Frankfort-on-the-Main, Germany, was made at the recently opened Bauer *cafe* with 167 Swan lamps fitted to the gas brackets, current being supplied by a Weston dynamo driven by a 20-horse gas engine.

—— A very superior quality of insulated wire is now being made by the Triplex Wire and Rubber Co., 159 Front-street, New York. Several of our principal electricians have thoroughly tested it, and the Edison Company and others using it endorse it very highly.

—— The conclusion arrived at by M. Hospitalier in an article on this subject in *L'Electricien* is that alternate currents may produce mechanical work like continuous currents, whether synchronism be insisted upon or variable speed be admitted; but in both cases alternate currents are less convenient and less economical than continuous currents.

——The question of using the electric light exclusively on some of the principal thoroughfares was brought up before the Board of Aldermen last Saturday, and received favorable consideration. Mr. H. W. Pope, representing the Citizens' Electric Light Company, of Brooklyn, E. D., claimed that Mr. Tate's estimate of the distance was arrived at by placing the lights on the corners. If they were placed straight along one line a distance of 300 feet apart, sufficient illumination would be given. Twenty or thirty times as much light would be given in any part of a street as was given by gas. Then again this city got a number of electric lights free, which, according to Mr. Tate, was about $5,000 a year saved in the appropriation, and so the number of lights taken by private consumers increased the number furnished the city free, also. The city got an additional light for every thirty taken by private subscribers.

*** We have often spoken of the superior advantages of copper wire for telephone lines, both on the score of conductivity and of durability, and are glad to find that our statements are borne out by the experience of those who have put it to practical tests. We have this week been shown a letter from Mr. John I. Sabin, General Manager of the Sunset Telephone Company, of San Francisco, addressed to the Palmer Wire Company, in which he says: "I made a personal examination of the copper wire which we put up four months ago between Vallejo and Napa, fifteen miles, and I found that the wire was in exactly the same position in which we placed it, that is to say, there was no elongation whatever, although we have had what is for us a hard winter, in the shape of wind and rain. We shall use copper wire exclusively from this time on for extra territorial work, and also use copper wire in exchange work for those subscribers who have much use for extra territorial lines. For this latter work we have been using your fifty pound-to-the-mile wire in San Francisco, and find a marked improvement when these local subscribers are working through to extra territorial points." As is well known, Mr. Sabin is one of the most experienced and well-informed telephone managers in the country, and his thorough indorsement of copper wire, based on the experience of actual use, is of the greatest value. Telephone companies are learning that the expense for wear and tear, when iron wires are used, is a serious item, one that interferes seriously with profits and dividends. With copper at its present exceptionally low price, copper wire is not only preferable, but much more economical in the end.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEBRUARY 10, 1885.

311,194 Joint for electric arc light cables; Wm R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

311,933 Thermostat; George R. Williams, Ithaca, N. Y.

311,944 Telephonic circuit and apparatus; Louis A. Berthon, Paris, France, assignor to the Societe Generale des Telephones, same place.

311,957 Telegraphic and telephonic instrument protector; George A. Cardwell, Brooklyn, N. Y., assignor to himself, Frederick K. Fitch, New York, N. Y., and Joseph T. Murray, Newark, N. J.

311,977 Memorandum Holder for telephone boxes James F. Gilliland, Indianapolis, Ind.

311,979 Telephonic Transmitter; John H. Guest, Brooklyn, N. Y.

312,111 Armature for dynamo electric machines; Frederick K. Fitch, New York, N. Y, assignor to the Fitch Electric Lighting and Construction Company, same place.

312,160 Telephone transmitter; Charles A. Randall, New York, N. Y.

312,161 Telephone transmitter; Charles A. Randall. New York, N. Y.

312,162 Telephone receiver; Charles A. Randall, New York, N. Y.

312,184; Electric arc lamp; Charles F. Brush, Cleveland, Ohio.

312,231 System of firing battery guns in turrets by electricity; Theodore R. Timby, Nyack, N. Y.

312,242 Cut-out for electric apparatus; Sidney H. Short, Denver, Col.

312,243 Feed regulator for electric arc lamps; Sydney H. Short, Denver, Col.

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